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Volodymyr Sarioglo,
National Academy of Science of Ukraine,
Institute for Demography and Social Research,

STATISTICAL ESTIMATION OF THE PAYMENT CAPACITY AT THE MUNICIPAL LEVEL

Scientifically proved approach to development of a tariff policy at the state, regional and local levels is the important precondition of social and economic development of regions. In market economy the tariff policy is appreciably defined by ability-to-pay of the population and the enterprises at the local level.

Problem of a possibility of the adequate analysis of the ability-to-pay of municipal services consumers gets a special urgency in process of dynamic reforming of housing-and-municipal sphere in Ukraine and in other post-soviet states [1, 2]. Reliable definition of the population ability — and willingness-to-pay for the consumed municipal services enables development and introduction of an effective social and tariff policy, overcoming of a consumer's debts problem, increase of appeal of the municipal enterprises for investors, planning of the municipal development programs, etc.

In such conditions the role of the supply with information of the governmental and legislative structures activity on the state, regional and local levels as well as administration of municipal enterprises, political and public organizations essentially increases.

The known international organizations, such as the World Bank, the European Bank of Reconstruction and Development, the US Agency on the International Development and oth. are engaged in researches of the population ability-to-pay in housing-and-municipal sphere.

Separate researches in Ukraine have been executed within 2001—2003 by PADCO advisory firm at fulfillment of work under the project «Reforming of tariffs and re-structuring of the municipal enterprises in Ukraine» [3, 4]. Now the certain works in this direction are carried out in the Institute for Demography and Social Research of

National Academy of Science of Ukraine, in the Institute of local development and in Ukrainian Center of social reforms.

In this report the basic principles of the ability-to-pay statistical estimation of the separate cities population and its willingness to pay for the consumed municipal services are dealt with.

As information base at analysis of features of consumption by the population of housing-and-municipal services as well as ability — and willingness-to-pay for them is expedient to use various information that exists or can be received on the local level and directly or indirectly connects with the purpose of research.

Nucleus of information base is the socioeconomic characteristics of the population which include the following groups of indicators [3]:

— demographic (household size, composition and its sex-and-age structure);

— economic (household types defined by employment status of its members, income formation sources and size, directions of their use, the household property, etc.);

— social (levels of providing with habitation and municipal services, of population education, nutrition, characteristics of consumption of food as well as non-foods and services, types and amounts of population social benefits, etc.).

The main source of information on demographic, economic and social characteristics of population on microlevel is the state sample surveys of population (households), first of all Sample Survey of Household Living Conditions data. Such data of this survey as household composition, number of children, housing conditions, household members' educational level and employment status, population incomes and expenditures, etc enable to establish dependence between household well-being and character of consumption of the goods and services by them. The survey also provides information on household property stratification. Unfortunately, pointed sample survey data have insufficient level of reliability on local level that demands application of special procedures for their specification.

For increase of estimates reliability of incomes and expenditures indicators the method of composite estimation on the basis of synthetic estimates is used in the article [5]. Synthetic estimate is indirect indicator estimate for small area, received on the basis of estimate for large area that includes the pointed small area. The composite estimates are calculated on the basis of both the small area direct indicators estimates and indirect estimates, in this case — the synthetic estimates.

For adequate research of the ability — and especially willingness to pay it is necessary to execute the special population sample surveys

on questions of providing of city population with municipal services as well as arising problems, which first of all are necessary for solving by local authorities and the municipal enterprises.

Such survey is expedient to carry out once in two years or once in one year under condition of dynamic development of municipal sphere.

The sample for such surveys is built as probable, representative for all city on the basic groups of households and types of dwelling. The sample size, as a rule, is equal about 1000 households. During survey organization it is necessary to organize an opportunity of complex use of its results with other data over the city, in particular with data of Household Living Conditions Survey (if this city is surveyed on questions of living conditions and these data can be available).

The source of information, which is difficult for overestimating, is the administrative data on the pilot cities. First and foremost, it is data from CSEs' records concerning payments for services by residential customers (tariffs, privileges, amounts paid and overdue, existence of utility meters, etc.).

The important source of information without which the results of analysis of the ability-to-pay of municipal services consumers will be incomplete is normative and legal acts, which adjust consumption of housing-and-communal services by population, and especially local government acts. Also the account of historical aspect of granting and consumption of concrete services is important.

Let's consider the results example of specification of incomes and expenditures indicators estimates on the level of separate city. It should be noted that receiving of Household Living Conditions Sample Survey data over separate city in most cases is impossible without special data preparation that can be made only by corresponding department of data preparation of the State Statistics Committee of Ukraine

Data that illustrated the results of the estimation specification of cash expenditures are presented in table 1.

In this case the data for which CV is below 10 percent is considered sufficiently reliable.

At specification of indicators in Khmelnytsky city as synthetic estimates are used the indicators estimates on urban areas of Khmelnytska oblast.

Table 1

STRUCTURE OF HOUSEHOLD CASH EXPENDITURES IN KHMELNYTSKY CITY (BY THE DATA OF HOUSEHOLD LIVING CONDITIONS SURVEY IN 2001)[31]

Components of cash expenditures	On average per household, UAH		Coefficient of variation ,%		% of cash expenditures	
	before specification	after specification	before specification	after specification	before specification	after specification
Food	249,69	251,14	16,04	8,10	59,36	58,87
Nonfoods, services including:	134,76	132,50	16,86	11,37	32,03	31,06
housing-and-municipal services	29,89	27,77	16,78	6,93	7,11	6,51
Consumer expenditures	384,45	383,64	13,18	7,62	91,39	89,93
Other cash expenditures	36,23	42,95	50,38	8,29	8,61	10,07
Total cash expenditures	420,68	426,59	12,14	7,50	100,00	100,00

Let's consider further the approaches to estimation of the population ability-to-pay for the municipal services. The approach, which is effectively used in practice for this problem decision, is the modeling on the basis of multiple line regression equation. This model is built on the basis of the data of the specialized sample survey of municipal services consumers on city and the municipal enterprises data about the sums of charges for the given to household services. For example, with this purpose for Khmelnytsky city in the microdata files were created new variables:

1) «Whether you agree to pay more for cold water supply and wastewater disposal services?» This variable equal to 1, if household which uses cold water supply and wastewater disposal services is ready to pay more and it is equal to 0, if not;

2) «Whether you agree to pay more for centralized hot water supply services?» This variable equal to 1, if household which uses centralized hot water supply services is ready to pay more and it is equal to 0, if not;

3) «Whether you agree to pay more for district heating services?» This variable equal to 1, if household which uses district heating services is ready to pay more and it is equal to 0, if not.

[31] The calculations are executed at active participation of scientific employees of the Department of Social-Demographic Statistics of IDSR of NASU Ogay M. and Lysa O.

On the basis of these variables the productive indicator was created «The wish to pay more for services of appropriate quality» on each household's group which are determined by choosing factorial variables (see further) and use corresponding services. The wish to pay more for each group was determined as the relation of households number which wish to pay more to all surveyed households.

The following binary (structural) indicators were used as factorial variables:

HSIZE_2 — two-person household (1 — yes, 0 — no); *HSIZE_3* — three-person household (1 — yes, 0 — no); *HSIZE_4* — four or more person household (1 — yes, 0 — no); *INC_2* — household in the second quintile group (1 — yes, 0 — no); *INC_3* — household in the third quintile group (1 — yes, 0 — no); *INC_4* — household in the fourth quintile group (1 — yes, 0 — no); *INC_5* — household in the fifth quintile group (1 — yes, 0 — no); *ID_PENS* — household with pensioners (1 — yes, 0 — no); *ID_CH3* — household with children under three years (1 — yes, 0 — no).

Except for these variables, which by results of the executed researches have come to final models, it has been considered a lot of other binary variables (presence of children in household, presence of working persons, the location of the household, type of dwelling and so on) which influence on willingness to pay more is appeared rather insignificant.

The general form of the linear probability model for each service id defined by the formula:

$$p = \beta_o + \beta_1 b_1 + \beta_2 b_2 + ... + \beta_n b_n, \quad (1)$$

where p is the empiric probability of the willingness -to-pay more for the service of better quality; b_i are the binary factorial variables (income group, household-size group, etc.), $i = 1, 2, ..., n$; β_0 is the absolute term that has a value of the empirical probability of the willingness-to-pay more for the household group corresponding to the zero values for all binary factorial variables; β_i are the regression coefficients representing the impact of each factorial variable (at $b_i = 1$) on the empiric probability of the willingness-to-pay more, $i = 1, 2, ..., n$.

Models were constructed separately on each city for household consuming the services of cold water supply and wastewater disposal, centralized hot water supply and district heating.

The final form of models for Khmelnytsky city is presented in table 2.

It is necessary to remember that all independent (factorial) variables in this model are binary variables, i.e., they can take only one of two possible values (0 or 1).

It should be paid attention that in separate models presented in table 2 not all factorial variables are used. For example, model by service of cold water supply and wastewater disposal doesn't contain the variables *INC2, INC3, HSIZE_2*. It reflects the fact that pointed variables not essentially influences productive indicator value but their use worsens model quality.

Besides at modeling it should be taken into consideration that absence of *INC2, INC3* variables means, that households with incomes corresponding to the first, second and third quintile groups are dealt as households of one group on incomes. Similarly, the absence of *HSIZE_2* variable means, that one— or two-person households are dealt as households of one group on size.

Table 2

THE WILLINGNESS OF KHMELNYTSKY CITY POPULATION TO PAY HIGHER TARIFFS FOR SERVICES OF BETTER QUALITY

№	Model	Average willingness to pay	Characteristics of model quality
1	Households consuming cold water supply and wastewater disposal services: $p_h = 0.296 + 0.096 \cdot INC4 + 0.161 \cdot INC5 + + 0.155 \cdot HSIZE\_3 + 0.138 \cdot HSIZE\_4 - - 0.286 \cdot ID\_PENS$	0.322	$R^2 = 0.928$ $F = 30.735$ $(F_{cr(0.95)} = 3.34)$
2	Households consuming centralized hot water supply services: $p_g = 0.263 + 0.186 \cdot INC4 + 0.204 \cdot INC5 + + 0.165 \cdot HSIZE\_3 + 0.167 \cdot HSIZE\_4 - - 0.193 \cdot ID\_PENS$	0.386	$R^2 = 0.913$ $F = 20.909$ $(F_{cr(0.95)} = 3.49)$
3	Households consuming district heating services: $p_o = 0.242 + 0.168 \cdot INC4 + 0.176 \cdot INC5 + + 0.162 \cdot HSIZE\_3 + 0.225 \cdot HSIZE\_4 - - 0.262 \cdot ID\_PENS$	0.317	$R^2 = 0.879$ $F = 17.379$ $(F_{cr(0.95)} = 3.34)$

There are all bases to assert, that connection between productive and the chosen factorial indicators is adequately described by the received regress equations because in all cases value of determination factor R^2 is close to 1 and calculated value of the F— relation is essentially exceeds its critical value $F_{кр}$. Using this equation, it is possible to calculate willingness to pay more for any type of households.

As a whole, population of Khmelnytsky city is the fastest ready to pay centralized hot water supply services for higher tariffs in comparison with other kinds of municipal services.

As results of the analysis testify, in Khmelnytsky city the willingness to pay is higher at households, which consist of three and more persons. Presence of pensioners in household's structure negatively influences on the willingness to pay higher tariffs.

Presence of children in the age under three years in household's structure positively influences on the willingness to pay more.

By results of the executed researches it should be noted the following. Problem of statistical estimation of the population ability and willingness-to-pay for consumed municipal services is very urgent now in Ukraine and in other post-soviet states. Methodological approaches to the decision of this problem provides necessity of reliable estimates if population incomes on the municipal level and necessity of the special sample surveys carrying out for estimation of the population willingness-to-pay for municipal services. Methods of statistical modeling on microlevel are the important toll of ability and willingness-to-pay estimates receiving.

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Oleksandr Gladun,
Institute for Demography and Social Researches
of National Academy of Sciences of Ukraine

SAMPLE DESIGN RESEARCH ON THE BASIS OF HOUSEHOLDS SAMPLES SIMULATION

One of the main stages of sample surveys preparation and carrying out is the sample design development. The procedure of its formation, realization and its influence on the sample results require special theoretical and practical researches.